Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Coastlines
August 2003 - Issue 13.4

Table of Contents

Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Conservation Partnership Creates California's Newest Ecological Reserve near Morro Bay

A 580-acre ranch, once slated for a golf course and resort, has become California's newest ecological reserve. The property straddles coastal Highway 1 near Morro Bay below Hollister Peak, a famous landmark along this scenic coastal route. This huge open space acquisition was made possible through the collaboration of the Trust for Public Land (TPL), the Morro Bay National Estuary Program (MBNEP), and the State of California.

The dramatic and beautiful scenery of this parcel made it highly attractive for development. At the same time, the MBNEP had earmarked the property as its highest priority for open space acquisition because of its high ecological value.

Approximately 1.5 miles of Chorro Creek, which drains the largest watershed emptying into Morro Bay, flows through the property. This reach of Chorro Creek, together with a major tributary that also runs through the site, is covered by dense riparian vegetation that provides good habitat for the threatened Southern steelhead trout and other special status species. Grasslands, chaparral, and oak woodlands growing on the hillsides above the creeks create a rich mosaic of upland habitats.

The CCMP identifies excessive siltation and sedimentation of Morro Bay as the estuary's most significant problem. Trapping silt otherwise bound for the estuary is especially important as the bay is filling at an unnatural rate. Floodplains, which are currently cut off from their creeks by levees and filled wetlands converted to fields, could be restored to their natural functions of trapping sediment and providing freshwater wetlands.

Portions of the ranch were also used for row crops and an orchard, which were irrigated with groundwater and creek water. Water diversion has been especially significant for steelhead trout, which used to be more common in the Morro Bay watershed. Despite its proximity to the coast, the climate is arid, and rain rarely falls between between April and November. Discontinuing irrigation would end the diversion of hundreds of acre-feet of water each year from the creeks. Restoring a more natural water budget to the streams would help the steelhead trout population to recover.

An extraordinary opportunity to acquire this ranch for open space arose in 2000. Frustrated by the permitting process required to develop the parcel, the owner placed the property on the market. The MBNEP contacted the owner, had the property appraised, and then facilitated an option and purchase agreement between the owner and the Trust for Public Land. TPL is a non-profit organization which

protects open space through acquisition. TPL's experience with land deals and their ability to identify funding sources proved essential to the project.

Raising the approximately $5.0 million needed to buy the property was a lengthy process, despite strong support from a number of agencies and non-profits. When the option was about to expire in March 2002 and the owner refused to extend it, the Packard Foundation gave TPL a low-interest loan so that they could buy and hold the property until the public funding was assembled.

Meanwhile, several agencies were cobbling together monies from various sources to buy the land from TPL and transfer it to the State for permanent protection. The Wildlife Conservation Board, the Department of Fish and Game, and the State Coastal Conservancy took the lead. Other major contributors included the California Resources Agency and the California Department of Transportation, which recognized the property's remarkable scenic value along Highway 1. The U.S. Fish and Wildlife Service also supplied a grant critical to the final package.

In May 2003, two years after the original option was signed, the State finally was able to buy the property from TPL, who had held it all this time. The property was re-named the "Chorro Creek Ecological Reserve."

The partners agreed that turning the site into an ecological reserve, to be managed by the Department of Fish and Game (DFG), would best facilitate the aims of removing the irrigated crops and orchard, opening the levees to create a more natural stream morphology, and recreating wetlands in the floodplain. However, with the State facing an unprecedented budget deficit, DFG was not well positioned to take on a new management responsibility, much less spearhead a major restoration effort.

The MBNEP was able to move the project forward by entering into a cooperative agreement with DFG to help manage the property. The MBNEP also pledged at least $200,000 of its funds towards planning and implementation of long-term restoration and protection strategies.

Managed grazing will continue while the design for restoration is being worked out, to help control weedy exotic plants from overtaking the property. Dry farming cover crops in selected areas will also be allowed in order to prevent erosion during the planning stage. The MBNEP and DFG are working with the local Resource Conservation District and the Natural Resources Conservation Service to define BMPs for grazing and dry farming appropriate for the property.

The partners are looking forward to the restoration plan, while recognizing that such

complex work will require the expertise of biologists, hydrologists, engineers and even historians/archaeologists and could take two years to complete. Community input will also be sought as the plan develops.

During the past year, TPL improved the viewshed by dismantling billboards and giant air blowers that had been installed by the previous owners to keep an avocado orchard from freezing in winter. The orchard was taken out of production to eliminate pesticide use and to eliminate the need for irrigation. A plan to transplant the trees to other locations proved infeasible when an arborist deemed the mortality rate too high to make the effort cost-effective. The trees were removed to prevent harboring pests and diseases that could infest other orchards on nearby properties. Resource managers will try to determine whether native chaparral or grassland restoration is practical at that location.

Although the purchase took over three years to complete, a key property in the Morro Bay watershed has been permanently protected. The Chorro Creek Ecological Reserve is a monument to the active cooperation of several State agencies, TPL, MBNEP and others, and their persistence in the face of many economic and bureaucratic hurdles.

Contact: Michael Multari, Director or Cheryl Lesinski, Public Outreach Coordinator, Morro Bay National Estuary Program, 601 Embarcadero, Suite 11, Morro Bay CA 93442; Phone: (805)-772-3834; Fax 805-772-4162; email: clesinski@mbnep.org; website: http://www.mbnep.org

Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

September 27, 2003 is National Estuaries Day!

EPA and NOAA are once again sponsoring an interactive Web session of **EstuaryLive 2003** to celebrate National Estuaries Day. **EstuaryLive 2003**, scheduled for September 25 - 26, 2003, offers students worldwide the opportunity to take real-time interactive tours through eight National Estuarine Research Reserves (NERRs) and National Estuary Programs (NEPs):

September 25, 2003:

9:00 am	North Carolina NERR and Albemarle-Pamlico NEP
10:00 am	Charlotte Harbor NEP and other Florida NEPs and NERRs
11:10 am	Galveston Bay, Texas
12:20 pm	Jacques Cousteau NERR and Barnegat Bay NEP in New Jersey
1:30 pm	Padilla Bay NERR and Puget Sound Action Team (NEP) in Washington

September 26, 2003:

11:00 am	North Carolina NERR and Albemarle-Pamlico NEP

11:45 am	Barataria-Terrebonne NEP in Louisiana
1:00 pm	North Inlet-Winyah Bay NERR in South Carolina
2:10 pm	South Slough NERR in Oregon

All times are in EST. For more information, please go to www.estuarylive.org EXIT disclaimer or contact Betsy Salter at 202-566-1244 (salter.betsy@epa.gov) or Becky Weidman at (617) 472-7760 (Rebecca.Weidman@verizon.net).

Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Getting to the Bottom of It: Benthic Mapping of the Hudson River

Land managers and planners have long used aerial photography and interpretive maps to visualize the land they are managing. But no such maps existed for the underwater portions of the Hudson River Estuary. The lack of such a basic tool has severely hampered Hudson River managers.

In 1998, however, the Hudson River Estuary Program of the New York State Department of Environmental Conservation (DEC), and the Hudson River National Estuarine Research Reserve began a huge benthic mapping project to map the underwater portions of the Hudson River Estuary - an area of over 300 square kilometers. The objective is to map sediments and bottom topography. Maps of anthropogenic deposits, recently deposited sediments, sediment grain size, sediment dynamics, river bottom morphology, and benthic habitat will be produced.

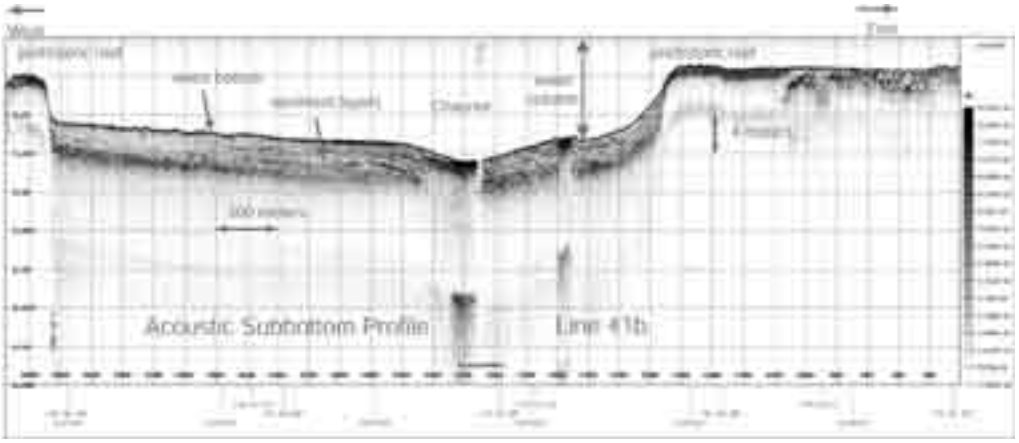
This is the first-ever comprehensive benthic mapping of the Hudson River Estuary. The information will be used to better understand and manage estuarine habitat, sediment and contaminant transport, and to understand how the estuary changes over time.

Because sediment grain size and sediment transport are linked to flow regime, documenting sedimentation will also help managers to understand how water flow patterns have changed over time. The maps will also assist with environmental enforcement and navigation. Finally, there is even a chance of locating historic artifacts.

Scientists from Columbia University and the State University of New York at Stony Brook are using geophysical remote sensing tools to map the bottom and sediments. Their tools are multibeam swath sonar, sidescan sonar, and ground-penetrating radar and sonar, which allow large-scale mapping of topographic features and the physical nature of the sediments.

Sampling of sediment provides small-scale "ground-truthing" to help interpret the large-scale remote sensing data. For example, with support from NOAA's Coastal Services Center, scientists from the Virginia Institute of Marine Sciences collected sediment profile imagery (SPI) that provides cross-sectional images of the sediment-water interface. Such "windows" can tell us whether animals and plants are using the bottom as habitat, whether sediments contain enough oxygen to support aerobic organisms, and even the likely chemical composition of sediments.

To obtain acoustic images, sonar is directed toward the bottom and the energy that bounces back is measured. The time it takes for sound to travel to the bottom and back is recorded, together with the signal strength. The signal is controlled by river bottom properties, such as sediment grain size, sediment cohesiveness or "stickiness", bottom roughness, and benthic plants or animals. Signal variations are then plotted to create maps that depict different characteristics of the bottom.



Acoustic subbottom profile across the Tappan Zee showing layered sediments beneath estuary floor. Prehistoric reefs are oyster

reefs composed of layers of oyster shell ranging in age from 700-6400 ybp.

Our sampling program is designed to allow us to understand the physical processes that created these features in the first place, and to create interpretive maps. For example, when we map areas of erosion or deposition, we are also mapping how the river is likely to change over time and the pathways for sediment transport. Also, contaminants are known to adhere preferentially to fine-grained sediments such as silts and clays. By mapping fine-grained sediments, we are also creating maps of contaminant distribution to help resource managers.

Benthic Habitat

Wildlife and fish feed on benthic invertebrates such as insects, crustaceans and worms. Fish such as sturgeon, tomcod, white perch, and young-of-the-year striped bass, herring, and shad rely upon such benthic organisms. The distribution of this benthic "food" is controlled by environmental factors such as the proportion of mud vs. sand, sediment organic matter, microbial content, sediment stability, and water movement. Mapping these variables will help us to locate important fish habitat in the estuary.

Various fish species also depend on river bottom morphology for refuge. Smaller fish often retreat into the shallows to avoid larger predators. In winter, when fish are less active, they may seek out deep quiet areas to avoid being swept away. Bathymetric mapping is helping us to find and protect such refuges.

Measurement Techniques

A combination of sidescan sonar, multibeam swath sonar, subbottom profiling sonar, and ground-penetrating radar (GPR) is being used to image the estuary floor, because each system has different advantages and limitations. When used together, they provide a comprehensive picture of the estuary bottom. Sidescan sonar and multibeam swath systems produce maps of the estuary floor. Sidescan sonar permits us to image the riverbed in shallow (less than 15 feet) and deep water, but does not measure water depth. Multibeam swath sonar allows us to image the river bottom and measure water depth for every square meter of riverbed; however, it is only feasible for water depths deeper than 15 feet. Since about half of the estuary from Yonkers to Catskill is less than 15 feet deep, the multibeam system is limited in areal coverage compared to the sidescan system.

Sediment Profile Image, estuary bottom, Tappan Zee. This photograph of the upper 15 cm of sediment shows a burrow extending about 12 cm down from the sediment-water interface, which is dominated by abandoned oyster shells. Shading of the upper few cm of sediment indicates oxygenated sediment. With depth, the shading changes to black, indicating a reducing environment. Vertical streaking is due to extensive burrowing.

Subbottom profiling sonar and ground-penetrating radar (GPR) produce vertical profile images of the sediment. Subbottom profiling is most useful for mapping areas that have experienced recent erosion or deposition. Acoustic profiling is useful in all depths, but does not work well where the river bottom is hard or where sediments contain gas arising from organic decomposition. GPR is not hindered by hard bottom or the presence of gas, but it does not work in more saline waters or in depths greater than 15 feet.

We also use a sediment profile imaging (SPI) camera to photograph cross-sections of the upper few inches of sediments. This lets us see and inventory animals living in and on the sediments, the depth of the oxygenated layer of sediments that supports benthic fauna, invertebrate burrows, gas pockets, sediment layers, surface roughness and other habitat features.

To measure grain size, sediment composition, and sediment structure, sediment cores and sediment grabs are taken. Again, there are tradeoffs. Sediment cores provide information on sediment structure, depositional history, sediment composition and grain size. Grab samples let us measure only the latter two parameters, but are cheaper to collect and process.

Results

Sediment classification maps now exist for about two-thirds of the estuary. Typically there is a deep channel that contains coarser sediments, flanked by shallower margins that have finer sediments, which can provide habitat for submerged aquatic vegetation. Sediment waves, like sand ripples or small sand dunes, often occur, indicating fast-flowing water. This general picture applies to the Tappan Zee, Newburgh Bay, the Kingston to Saugerties reach, where sediment waves are over

two meters high in places, and north of the City of Hudson, where there are extensive underwater dunes.

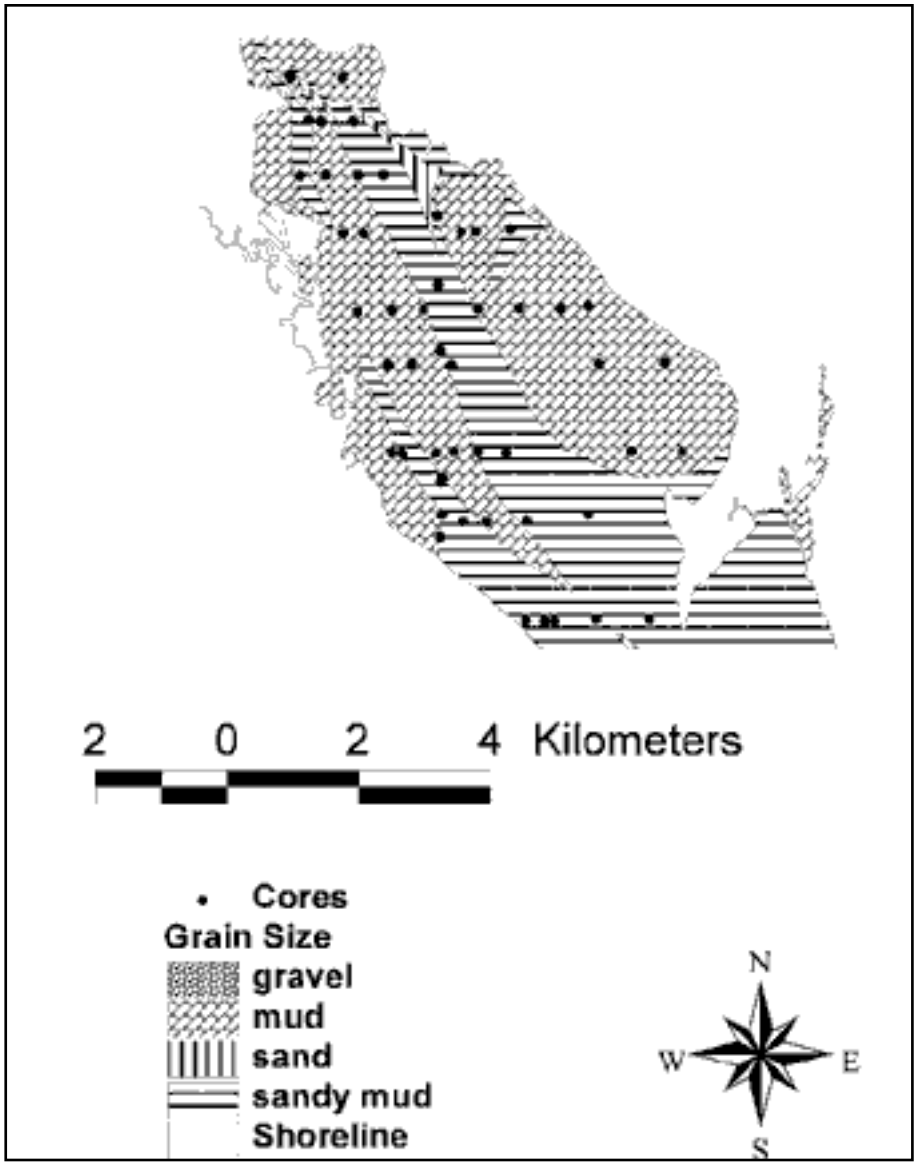
To our surprise, we have found and mapped large patches of dead oyster reef, in places buried by a few meters of sediment. Radiocarbon dating indicates that these reefs may date from 8,000 years before present (BP), to about 700 years BP. Between 3,000 and 4,000 years, however, no reef was deposited. One of the unsolved mysteries of the lower Hudson is what controls the occurrence of living oyster reefs.

Sediment distributions are also affected by manmade structures. South of the bridge abutments of the Newburgh-Beacon Bridge, ribbons of sediment extend over a mile downstream, deposited in the lee of the bridge abutments. Here, water velocity is lower than in the main stream, so suspended sediments settle out.

Fine-grained, unconsolidated sediments typically appear as low reflectivity areas in sidescan images. But in Haverstraw Bay, subbottom profiles revealed that high-reflectivity is associated with active erosion of the unconsolidated surface layer, exposing overcompacted, fine-grained sediment beneath. Integration of several methods is essential for accurately depicting the depositional environment of the estuary.

Throughout the estuary, evidence of human activity abounds. In many samples, we find coal and cinders from the days of coal-burning engines. There are debris fields and doughnut-shaped features that may have formed when material was dumped on the bottom. Scars remain from laying pipelines and cables. In the Tappan Zee, there is a large debris field off Hook Mountain where quarry rock was inadvertently dumped when the Palisades were being quarried in the 19th century. Numerous debris fields occur north of Hudson. In Newburgh Bay, there are fields of doughnut-shaped features, particularly near the Roseton power plant. Near Kingston just north of Rondout Creek, there is the scar of a buried pipeline crossing the river.

An analysis of sidescan images and sediment cores from Haverstraw Bay indicates four dominant sediment types: gravel, sand, sandy mud, and mud. The boundaries of the sediment provinces were determined primarily from sidescan imager.



Recently, working with scientists from the State University of New York at Stony Brook and the Institute of Ecosystem Studies, we have begun a pilot study to map invertebrate community assemblages in different sediment and bottom types. We are also helping fisheries biologists from the DEC and the U.S. Fish and Wildlife Service design experiments to determine if sturgeon prefer a particular bottom type or flow regime. Biologists, geologists, geophysicists, and geochemists are working together to interpret physical, chemical and biological data.

Swath bathymetry has revealed many acoustic targets that may be historic artifacts. State and federal laws protect historic artifacts, so until such time as the acoustic targets can be evaluated, this data cannot be made public. Paradoxically, release of data to scientists and the public would aid the DEC in managing resources and evaluating permits, but could potentially harm other missions (e.g., historic preservation).

Some benthic mapping data can be viewed at http://benthic.info. EXIT disclaimer We

are working to make the data available to the public, subject to the limitations described.

Contact: John W. Ladd, Benthic Habitat Coordinator, Hudson River National Estuarine Research Reserve, New York State Department of Environmental Conservation, 43 Hudson Watch Drive, Ossining, NY 10562; Phone: (914) 944-4373; email: jwladd@alumni.williams.edu

Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

San Francisco Estuary Project Awards Over $100,000 in Small Grants

The San Francisco Estuary Project (SFEP) recently awarded a total of $111,000 through its Small Grants Program, which is funded by EPA. SFEP's Small Grants are awarded annually for projects to be conducted during that calendar year. Grants range from $3,000 to $10,000. This year's grants will fund 17 projects, each of which is relevant to the entire Bay Area. A total of 30 proposals were received and reviewed, amounting to over $200,000 in funding.

The funded projects include many education and outreach efforts, including wetland and creek restoration projects and environmental education publications. One of this year's notable grant recipients is the Math/Science Nucleus in the City of Fremont. This group's goal is to alert local businesses and community groups about an important but often overlooked local watershed and its role in the overall ecology of San Francisco Bay. Using grant funds, they will publish a small booklet and distribute it throughout the city; they will also make slides available to local schools and environmental groups.

Another grant recipient is the Urban Creeks Council, who will use SFEP grant funds to supplement other grant monies to create a stewardship training program for local inner city high school students. The students will learn about the entire process of stream restoration, including initial stream surveys, creation of stream cross-sections and profiles, project construction, riparian insect surveys and other

monitoring activities.

A third funded project will also train students, focusing on a new National Wildlife Refuge that is being developed in the wake of a Navy base closure. The Golden Gate Audubon Society will work with local elementary students on a Least Tern Program, which includes learning about the life style of this endangered species as well as removing invasive parasitic vegetation from Least Tern habitat at the refuge. Students will learn to identify and count birds and identify and inventory plants and animals.

In a fourth project, the Alhambra Watershed Action Group will use grant funds to raise awareness and promote stewardship of the Alhambra Creek Watershed by producing and distributing a watershed map to local schools and the general public. The map will include natural features such as creeks, floodplains, and topography, as well as demographic information. This map will enhance established educational programs that are currently being implemented by the local watershed group.

We are excited about the breadth and depth of the projects being carried out by all

17 grant recipients. We look forward to their important contributions to the increased understanding and our stewardship of the Bay through implementation of actions contained in the Comprehensive Conservation Management Plan. We enthusiastically invite inquiries regarding next year's grant round and look forward to funding another exciting group of projects.

Contact: Carol Thornton, Regional Planner, San Francisco Estuary Project, 1515 Clay Street, Suite 1400, Oakland, CA 94612; Phone: (510) 622-2419; Fax: (510) 622-2501; Email: ct@rb2.swrcb.ca.gov

Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

NERR Graduate Research Fellows Receive Jones Award for Excellence in Graduate Studies

Four NERR Graduate Research Fellows were honored with Jones Awards at a recent ceremony held in Washington, D.C. Pictured (from left) are Brian Silliman, Narragansett Bay Reserve, RI; Kim Heiman, Elkhorn Slough Reserve, CA; Erica Seiden, Graduate Research Fellowship program coordinator, NOAA; Tenley Conway, Jacques Cousteau Reserve, NJ; Eileen Vandenburgh, North Carolina Reserve; and Vice Admiral Conrad C. Lautenbacher Jr., U.S. Navy (Ret.) Under Secretary of Commerce for Oceans and Atmosphere.

Four NOAA Graduate Research Fellows were recently awarded Walter B. Jones Memorial Awards for Excellence in Coastal and Marine Graduate Study. The Jones Awards honor those who exemplify innovation, resourcefulness, leadership and a commitment to balancing the human use of America's coastal and ocean resources with the needs of the resources themselves.

The National Estuarine Research Reserve (NERR) Graduate Research Fellowship

is a competitive program that provides master's and doctoral students with an opportunity to explore scientific questions of local, regional and national significance. The result is high quality research focused on improving coastal management issues.

The four Graduate Research Fellows who received the Jones Award are: Brian Silliman from the Narragansett Bay Reserve, Rhode Island; Kim Heiman from the Elkhorn Slough Reserve, California; Tenley Conway from the Jacques Cousteau Reserve, New Jersey; and Eileen Vandenburgh from the North Carolina Reserve.

At the Narragansett Bay Reserve in Rhode Island, Graduate Research Fellow Brian Silliman is studying the role played by grazing snails and their predators in structuring New England and southern salt marshes. He is questioning a long-held theory of salt marsh ecology that nutrients and physical factors are the primary determinants of salt marsh primary production.

His experimental research indicates that if marine predators, such as blue crabs, are removed from southern marshes, the entire ecosystem may collapse. In small-scale caging experiments, Silliman found that periwinkle snails flourish and vigorously consume salt marsh cord grass when their main predator, the blue crab, is removed. These results suggest that a simple trophic cascade may regulate salt marsh primary production.

At the Elkhorn Sough Reserve in California, Kimberly Heiman is investigating the effects of invasive species on the physical environment and biological communities. Her project focuses on an invasive reef building species called Ficopomatus enigmaticus. The reefs created by this species are highly complex, hard substrates that represent a new habitat for Elkhorn Slough.

Heiman is studying physical changes to the hydrology and sediment caused by the presence of Ficopomatus reefs. She is conducting transplant experiments to determine how these reefs change the ecosystem, and is monitoring the recovery of benthic communities after the removal of established reefs. She is also documenting the rate at which reefs are established. Heiman's findings will be used to develop recommendations to better control and manage this invasive species.

Tenley Conway's research at the Jacques Cousteau Reserve takes place within the Mullica River and Barnegat Bay watersheds, which are two of the least disturbed areas in the heavily urbanized Northeastern United States. However, portions of the region are undergoing rapid land use changes. Although a great deal is already known about past land use changes in the region, comparatively little has been done to project future land use pressures. Work of this kind is essential in

developing appropriate management strategies to protect the unique coastal environment. Tenley is working to integrate future land use change modeling and stakeholder participation into a planning framework that addresses the management needs of the coastal watersheds.

At the North Carolina Reserve, Eileen Vandenburgh is investigating the important question of how marine protected areas (MPAs) affect patterns of recruitment. The use of reserves as spawning banks depends on the transport of eggs, larvae or juveniles out of the protected area. There is a critical lack of evidence that larvae disperse and enhance recruitment outside the refuge. Vandenburgh is investigating the function of MPAs as larval export reserves and their contribution to sustaining fisheries outside the boundaries of the reserve. She is comparing the spawning stock biomass of hard clams within and outside reserves to determine whether larval supply and local recruitment of clams is greater in and around refuges than in and around harvested areas. She is also modeling the spatial patterns of clam recruitment associated with closed and open areas at local and regional scales.

Graduate Research Fellows conduct their research in one of the 25 National Estuarine Research Reserves. Fellows also have the opportunity to participate in their host reserve's research and monitoring program, which provides hands-on experience that enhances their fellowship training. Projects focus on one of the following estuarine ecosystem topics:

- Eutrophication, effects of non-point source pollution and/or nutrient dynamics;
- Habitat conservation and/or restoration;
- Biodiversity and/or the effects of invasive species;
- Mechanisms for sustaining resources within estuarine ecosystems; or economic, sociological and/or anthropological research applicable to estuarine ecosystem management.

Fellowship funds support management-related research projects to enhance scientific understanding of the reserve ecosystem, provide information needed by reserve management and coastal management decision-makers, and improve public awareness and understanding of estuarine ecosystems and estuarine management issues.

The reserve system is a network of protected areas that represent different biogeographic regions of the United States. Each reserve is a "living laboratory" in which scientists conduct research and educators communicate research results.

Contact: Erica Seiden, Estuarine Reserves Division, Office of Ocean and Coastal Resources Management, National Oceanic and Atmospheric Administration, 1305

East-West Highway N/ORM5, Silver Spring, MD 20910; Phone: (301) 713-3155 ext.172; Fax: (301) 713-4363; Email: erica.seiden@noaa.gov

For information about the Reserve system and fellowship project examples, please see the Web site at www.ocrm.nos.noaa.gov/nerr. EXIT disclaimer

Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

November 3-5, 2003
Conference on Stormwater Management for Cold Climates

The first North American conference focused specifically on the challenge of managing stormwater in cold climates. This conference is organized by the Casco Bay Estuary Project, Maine Coastal Program and Cumberland County Soil and Conservation District in cooperation with Center for Watershed Protection, the U.S. Environmental Protection Agency, and the New England Interstate Water Pollution Control Commission.

For further information, contact Karen Young, Casco Bay Estuary Project (207) 780-4820; or Todd Janeski, Maine Coastal Program (207) 287-1482; or visit http://www.cascobay.usm.maine.edu/coldsw.html EXIT disclaimer

Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Fresh Water Input is Key to Apalachicola Bay Values

Superlatives describe the Apalachicola watershed and Apalachicola Bay. The Apalachicola River is the largest in Florida and ranks 21st in the U.S. in terms of flow. Its floodplain encompasses 15 percent of the river's drainage area in Florida, or about 144,000 acres. It is one of the most undeveloped, pristine, and unique aquatic systems left in the United States.

The Apalachicola estuary is the most productive estuary in Florida. More than 1,300 plant species, 46 amphibian species, 83 reptile species and more than 50 species of mammals are found in the Apalachicola watershed. The greatest number of fresh water fish species in Florida are found here. The Apalachicola River watershed lies on the eastern fringe of the Mississippi Flyway, hosting large numbers of birds from the Midwest and Atlantic Seaboard during the migratory season. The Apalachicola-Chattahoochee-Flint (ACF) River Basin, which drains Georgia, Alabama and Florida, boasts the greatest number of fish species among Gulf Coast drainages east of the Mississippi River.

Due to its outstanding resources, the Apalachicola National Estuarine Research Reserve (ANERR) was designated in 1979. Located in Franklin County in the Florida Panhandle, it is one of the largest NERRs, encompassing 246,00 acres of land and water. The Reserve includes the lower 52 miles of the Apalachicola River and its floodplain, two and a half barrier islands, uplands, and Apalachicola Bay.

Since 1990, however, a controversy over proposed upstream diversion of fresh water has engulfed the region, resulting in studies, lawsuits, environmental impact studies, negotiations, a federal compact between three states, and involvement of local and national citizen organizations. So far, there is still no agreement between the states.

The proposed upstream diversion of water poses a challenge: how should the diverse interests of three states be balanced? Any water allocation formula should provide for a fair and equitable sharing of the basin's water resources, taking into account the interests and needs of the states.

The importance of the Apalachicola River to estuarine productivity cannot be overemphasized. High water quality, seasonal flooding, nutrient and detrital transport and variable salinity provide ideal habitat for diverse and productive estuarine biota. Major estuarine habitats include oyster beds, submerged aquatic vegetation, tidal flats, soft sediment, tidal marshes, and open water. The Bay is a nursery for shrimp, blue crabs, and finfish, which are commercially important species. The Bay provides 90 % of Florida's oyster harvest, and supports an active finfish industry.

With 25 reserves in the U.S. and Puerto Rico, the National Estuarine Research Reserve System (NERRS) is ideally suited to conduct long-term monitoring to address estuarine management issues. In 1994, the NERRS and NOAA developed the System-Wide Monitoring Program (SWMP) to focus on three different ecosystem characteristics: abiotic factors, biological parameters, and watershed and land use classifications. The SWMP program monitors water quality, nutrients, chlorophyll, temperature, salinity, water level, dissolved oxygen and meteorological data. These data are reviewed for quality assurance, posted to a website, and archived in a Central Data Management Office.

Estuaries are transition zones between the ocean and the freshwater river. Salinity fluctuation is a key feature of estuaries, and helps to determine types and distributions of estuarine organisms. Salinity is determined by rainfall, river flow, tides, winds, and basin configuration. Alteration of a single variable, such as river flow or salinity, can significantly affect estuarine biota and ecological dynamics. Horizontal salinity gradients can form barriers to movement of organisms and screen out potential predators. Increases in salinity, in particular, could eliminate such barriers and significantly change estuarine species and ecology.

Many Reserve research studies show that Apalachicola Bay is a dynamic estuary. The bay is highly stratified near the mouth of the river, but becomes more mixed near the ocean. Strong horizontal salinity gradients exist between the river mouth and the Gulf.

At the eastern end of the Bay, salinity reacts quickly to changes in river flow, after only a one-day lag. Fluctuations in river flow during a normal year can explain as much as 10 ppt of salinity variability. Water level fluctuations, caused by tides and meteorological conditions, are the dominant factor influencing bottom salinity on the eastern side of the Bay. On the western side, fresh water river input is important. Local rainfall can also vary between the two sides of the Bay, causing local differences in salinity.

The Reserve is using long-term data on river flow, rainfall, wind speed and

direction, salinity, and water levels to model water circulation and salinity. These models successfully explain 86% to 91% of the salinity variability at opposite ends of the Bay. Their study points out the need for collecting long-term data and sampling at multiple locations to accurately characterize estuarine conditions.

Drought-related changes in river flow significantly affect salinity in the Bay, as shown by studies of the effects of the 1999-2002 drought. During drought years, salinity throughout the Bay typically increases from 6 to 8 ppt. This is of concern for the East Bay region since this is the fresher part of the bay, and is also the most important nursery area in the bay. Over a longer term, salinity increases could significantly impact the flora and fauna and habitats of East Bay and Apalachicola Bay.

The water budget of the Bay varies seasonally and annually, within limits. Winter peaks in flow are generally followed by low flows during the summer and fall. Estuarine species react to these annual changes in fresh water input by changing their distributions and numbers. However, these changes generally recur from year to year. Trophic organization in the Bay is probably stable within certain flow constraints, despite the dynamic nature of the system.

However, when abnormal flows occur, this dynamic equilibrium can be upset. Major trophic changes can ensue that last for several years, even after normal flow resumes. In the 1970's, a major drought caused river flows to drop below the long-term monthly average for 20 consecutive months. During this prolonged drought, biomass of herbivores and omnivores first increased dramatically as increased light penetration enhanced primary productivity. But then both trophic categories declined precipitously when primary production dropped due to decreases in river flow and nutrients. As herbivores and omnivores declined, so too did primary and secondary carnivores. Trophic dynamics only returned to pre-drought conditions when normal river flows resumed.

Maintaining historic river flow is vital to the economy and ecology of northwestern Florida. The exceptional productivity of this wetland system depends on the flow of the Apalachicola River, which depends in turn on inflow from upstream states. The ANERR hopes to include a comprehensive monitoring program in any water allocation agreement. This would enable the Reserve to detect any changes in the condition of the lower Apalachicola River and Bay over the long term. Such long-term monitoring information is critical for providing a sound scientific basis for coastal resource management, and for protecting the values of the Reserve.

Contact: Kim Miller, Environmental Specialist, Apalachicola National Estuarine Research Reserve, Florida Department of Environmental Protection, 350 Carroll

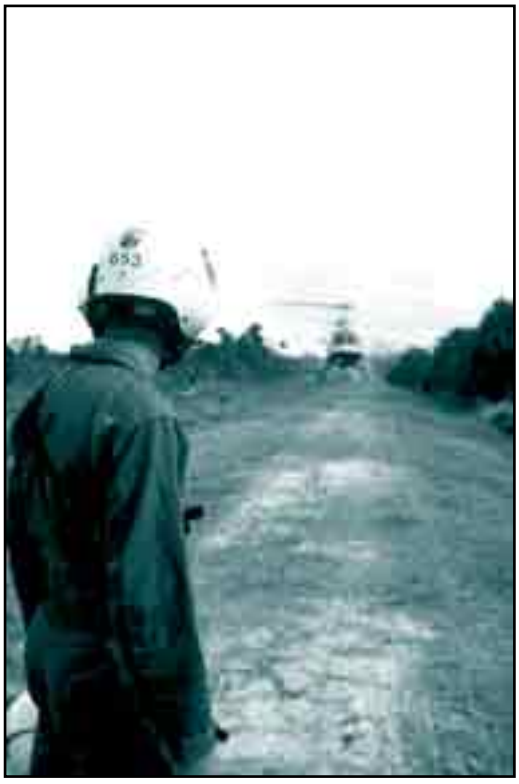
Street, Eastpoint, FL 32322; Phone: (850) 670-4783, x. 113; Fax: (850) 670-4324; email: Kimberly.miller@dep.state.fl.us

Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Monitoring the Reestablishment of Prescribed Fire in Southwest Florida

Introduction

At the Rookery Bay National Estuarine Research Reserve in Naples, Florida, a comprehensive prescribed fire program has been implemented. Administered by the Florida Department of Environmental Protection, the Reserve encompasses 110,000 acres of submerged habitats, mangrove forest, and uplands that are managed to restore and maintain maximum native biodiversity. Prescribed fire, also known as prescribed or controlled burns, is a beneficial method of reducing fire hazards and maintaining suitable habitat for native plants and wildlife. Ongoing research and monitoring is helping to assess the success of fire management strategies.



Past fire suppression on Reserve lands has caused natural fuels such as dry grass, brush, fallen timber and leafy debris to accumulate, increasing the threat of catastrophic wildfires that can threaten human safety, property and natural

resources. To reduce this risk, the Reserve's five-year Management Plan encourages the reduction of fuels through prescribed fire, thinning or other means. Little information is available, however, concerning the post-burn habitat and its short- and long-term suitability for resident wildlife. Wildlife habitat assessment is an important, though often overlooked, component of comprehensive, ecologically-based fire management.

Using Fire to Manage Coastal Scrub Habitat

Because coastal scrub habitat typically occurs in desirable coastal uplands, it has become endangered due to its fragmentation by development. Fortunately, nearly 420 acres of this habitat have been protected within Reserve boundaries. Consequently, this land must be managed to provide optimal habitat value and prevent catastrophic wildfires.

Coastal scrub was targeted for fuel reduction by Reserve managers during the winter 2002/2003 prescribed fire season. In conjunction with this, a long-term study is monitoring the effects of burns prescribed in coastal scrub habitat during two annual fire seasons: winter (January - February) and spring (May - June). Coastal scrub habitat is fire-dependent, meaning many of the endemic plants and animals benefit from periodic fire events occurring every 10 - 20 years or so. The dominant plant species in coastal scrub include sand and live oaks, saw palmetto and rosemary. Animal species that have historically relied on fire to maintain areas for travel and forage include whitetail deer, gopher tortoise (Species of Special Concern, State) and Eastern indigo snake (Threatened, Federal).

In order to ensure a safe and effective prescribed fire event, the Reserve's comprehensive prescribed fire plan outlines a strict operational protocol. Considerations include predetermination of burn units, procurement of proper staff and resources, and confirmation of appropriate weather conditions. The success of prescribed burns in coastal scrub habitat depends upon high winds and dry fuels, resulting in very intense fires. To reduce potential threats, coastal scrub burns are typically limited to 10-15 acres, and wind speed and direction must be closely monitored.

One of the greatest challenges faced by Reserve managers is the proximity of private developed property, such as homes, offices, shopping areas, golf courses and major thoroughfares. The proximity of this "urban interface" to protected Reserve lands means that fuel reduction is even more important in order to reduce the risk that catastrophic fires will cause property damage. However, burns conducted in such areas also require closer monitoring for smoke and ash impacts, as well as flare-ups.

Wildlife Habitat Considerations

Fire management at the Reserve includes assessment of the relationship between available fuel and wildlife habitat quality. To assess this, the monitoring program: 1) Records the quantity and quality of the fuel loads in different vegetation types among burn units; 2) Identifies the types and numbers of resident wildlife species; 3) Measures habitat quality by relating wildlife diversity and abundance to available fuel structure; 4) Evaluates direct and indirect effects of fuels management on wildlife habitat; and 5) Predicts the short- and long-term effects of fuels management on habitat structure, quantity and quality for resident wildlife species.

Monitoring Methodology

Since different fuel loads burn at different temperatures, a variety of surveying techniques are used to measure the degree of fire intensity. These include photo point comparisons, fuel load samples, and the use of temperature-sensitive paints. During the burn, parameters such as air temperature, relative humidity, wind speed, rate of spread, flame height, and burning pattern are also recorded.

Land managers at the Reserve have documented target burn zones with digital photographs, creating photo points. Using GPS technology, photos are taken consistently from the same location facing the same direction, and they are used for before and after comparison. Vegetation is inventoried in permanently marked plots. The initial inventory of vegetation provides the baseline conditions against which repeated measurements will be compared to detect changes brought about by the prescribed burn. Vegetation sampling methods were designed to allow detection of fire effects on community composition and dominance in the ground cover, shrub and canopy strata.

Use of temperature-sensitive paints has been extremely helpful in measuring fire intensity. These paints are applied to steel plates and installed at intervals throughout the pre-burn area. Generally, greater fuel availability results in a hotter fire. By examining the painted areas on the plate after the burn, fire temperature can be gauged along with relative fuel load and habitat value.

Standard capture-and-release animal trapping methods supplemented vegetation transects to quantify animal populations in the habitat. Pre- and post-burn monitoring of biological indicator species will be instrumental in measuring the effects of fire on habitat structure and its use by associated wildlife species. As many animal species are seasonally migratory, long-term collection of demographic information will be helpful in determining trends in habitat use. Indicator species that

are being monitored as part of the prescribed fire program include small mammals, reptiles, and amphibians, particularly tree frogs.

Resource managers anticipate that as the fire regime is reestablished over time, the results from the study will be used to guide future prescribed fire management for areas within the Reserve, and potentially serve as a model for other agencies in the region.

Contact: Tad Bartareau or Judy Haner, Florida Department of Environmental Protection: 300 Tower Road, Naples, FL 34113-8059. Phone: (239) 417-6310, fax: (239) 417-6315. E-mail: Tad.Bartareau@dep.state.fl.us or Judy.Haner@dep.state.fl.us.

Submitted by: Renee Wilson, Research Translator, Rookery Bay National Estuarine Research Reserve, 300 Tower Road, Naples, FL 34113. (239) 417-6310. Renee.Wilson@dep.state.fl.us.

Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Texas Partnership Along Nueces River Makes Largest Land Purchase Ever

A partnership between the Coastal Bend Bays & Estuaries Program (CBBEP) and The Nature Conservancy of Texas (TNC) will help the City of Corpus Christi to restore freshwater flow to the Nueces River Delta to revitalize a wetland that is crucial to the Gulf Coast. About 1,600 acres of wetlands will be protected by this land purchase, as part of a long-term regional water and land management plan to meet human and environmental needs for fresh water.

Part of the new Nueces Delta Preserve will be bought by the City of Corpus Christi for an overflow channel and pipeline corridor to deliver much-needed fresh water directly to the upper Nueces River Delta.

The delta provides critical nursery habitat for estuarine plants and animals, including recreationally and commercially important fish and shellfish species. The Nueces Delta Preserve is a dynamic ecosystem of highly productive wetlands, open water, islands, prairie, and river and bay shorelines. The river provides vital riparian habitat, while brackish wetlands

are home to shrimp, crabs, juvenile fish and birds. The uplands are brimming with native vegetation hosting a variety of wildlife.

One of the most important features of the Nueces Delta Preserve is the Rincon Channel, which is the primary channel for freshwater inflows to nourish the delta complex.

The CBBEP has made protection and restoration of the Nueces Delta a top priority, and it initiated efforts to acquire important wetlands and wildlife habitat in the Nueces River Delta in February 2000. The CBBEP has had tremendous success in securing funding for habitat acquisition.

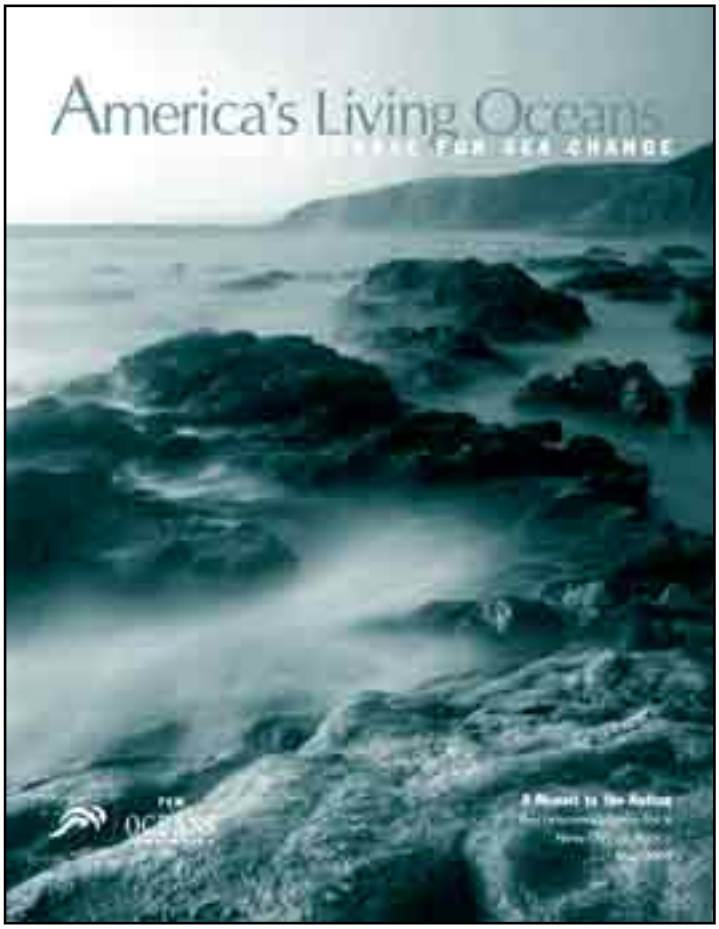
The Nature Conservancy of Texas first purchased the land until funding was available to the CBBEP. The CBBEP then bought the Nueces Delta Preserve from TNC on May 8, 2003, using funds from other sources, including federal grants. The TNC will continue to manage the land for conservation and maintaining biodiversity. The CBBEP and the TNC both plan to promote the site as a center for community conservation education, habitat restoration and scientific research.

The CBBEP is a local non-profit 501(c)(3) organization dedicated to protecting and restoring bays and estuaries of the Texas Coastal Bend. The CBBEP implements management solutions and supports research focusing on public health issues, living resources, loss of wetlands and habitat, water quality, estuarine circulation and fresh water flow, and debris.

Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Pew Oceans Commission Report Released

On June 4, 2003, the Pew Oceans Commission released its final report: America's Living Oceans: Charting a Course for Sea Change. The comprehensive report is the result of a three-year, nationwide study of the oceans, the first of its kind in more than 30 years. The Commission's report focused on five areas of inquiry: (1) aquaculture, (2) fishing, (3) coastal development, (4) marine pollution, and (5) introduced species. It provides recommendations for restoring and protecting ocean and coastal ecosystems, rebuilding fish populations, controlling coastal development, curbing pollution, and improving ocean governance.



The independent Pew Oceans Commission calls for immediate reform of U.S. ocean laws and policies to restore ocean wildlife, protect ocean ecosystems, and preserve the ecological, economic, and social benefits provided by oceans. The Commission is distributing the report to governors and to citizens in all 50 states

and territories, and in over 30 countries. The full report can be found at http://www.pewoceans.org/. EXIT disclaimer For more information, contact Jennifer Linn at 202-566-1258.

Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

Rookery Bay NERR Hosts State of the Coast Workshop

The May 2003 State of the Coast Workshop, hosted by the Rookery Bay National Estuarine Research Reserve, was the first of its kind in Southwest Florida. Over 75 people attended, including city, county, state, and federal officials. The goal of this workshop was to increase awareness about coastal resource management issues, describe the benefits of science-based information in decision-making, and promote stewardship among elected officials.

Among the many speakers were researchers from the Reserve, South Florida Water Management District, University of Florida, Florida Gulf Coast University, and Florida Marine Research Institute. Florida Representative J. Dudley Goodlette was the keynote speaker. We hope that this workshop will build strong relations and cooperation between estuary resource managers, public officials, and the public.

Contact: Renee Wilson, Research Translator, Rookery Bay National Estuarine Research Reserve, 300 Tower Road, Naples, FL 34113; Phone: (239) 417-6310 ext. 204; website: www.rookerybay.org EXIT disclaimer

Note: This information is provided for reference purposes only. Although the information provided here was accurate and current when first created, it is now outdated.

"What's an Estuary? Now You Know" Campaign

To celebrate National Estuaries Day on September 27, the Association of National Estuary Programs (ANEP), in partnership with the NERRs, will be launching their "What's An Estuary? Now You Know" campaign. The goal is to make the word "estuary" a household word, like "ocean" or "river," by 2005. ANEP has produced a multimedia presentation on the web ..... (website no longer available).
The presentation can be used to explain what estuaries are and why they are important. Other outreach tools will be posted on the website to increase public awareness and involvement in protection and restoration of estuaries. In 2004, a media campaign will be launched featuring national and local ads.

To learn more about the campaign or to become a partner, please contact ANEP's Executive Director, Dawn Volk, at 703/333-6150 (drvolk@erols.com).